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A NEW *BRUCHOPHAGUS* FROM *GLYCYRRHIZA LEPIDOTA* PURSH IN THE NORTHERN GREAT PLAINS (HYMENOPTERA: CHALCIDOIDEA: EURYTOMIDAE)

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Abstract.—A new species, ***Bruchophagus grisselli*** McDaniel and Boe, which infests seeds of *Glycyrrhiza lepidota* Pursh (American licorice), is described and illustrated. It's known from South Dakota and North Dakota in the USA. A field study at 8 sites showed that *B. grisselli* has a wide distribution throughout the Dakotas.

Key Words: infests seeds, American licorice

The genus *Bruchophagus* was described in 1888 (Ashmead 1888) without including any species or the designation of a type species. In 1894 Ashmead placed 3 species in his genus *Bruchophagus*: *borealis* Ashmead, *mexicanus* Ashmead and *funebris* (Howard) transferred from *Eurytoma*. Burks (1957) stated that Ashmead considered *B. borealis* and *B. mexicanus* to be parasites of bruchid beetles of the genus *Bruchus*. The third chalcid, *Eurytoma funebris*, included in *Bruchophagus* by Ashmead, was listed as a parasite of the clover-seed midge [*Dasineura leguminicola* (Lintn.)] by Ashmead. Hopkins (1896) and Titus (1904) concluded that *B. funebris* was phytophagous in clover seeds. Presently the generic name *Bruchophagus* has become affiliated with phytophagy in legume seeds (Burks 1957).

Out of a total of 8 recorded North American species of *Bruchophagus*, 5 have been collected from legume seeds while hosts of the other 3 species, *B. sculptus* (Ashmead), *B. noctua* Girault, and *B. borealis* are unknown. *B. mexicanus* has been described from seeds of several species of *Astragalus* native to North America (Burks 1957, 1979). Four species have been recorded from important introduced forage legumes, trees, or shrubs.

Glycyrrhiza lepidota Pursh is a widespread native North American legume that has potential for forage and conservation purposes (Boe and Wynia 1985). *Bruchophagus glycyrrhizae* Nikol'skaya was described from *Glycyrrhiza glabra* L. seeds in Europe. In the United States to date, only the bruchid beetle seed predators *Acanthoscelides aureolus* (Horn) and *A. fraterculus* (Horn) have been recorded from *G. lepidota* (Boe et al. 1988, Center and Johnson 1976).

This paper describes a new species of *Bruchophagus* collected from seeds of *G. lepidota* and presents information on its distribution in North and South Dakota.

Materials and Methods

Mature pods of *G. lepidota* were collected from 8 sites in North and South Dakota in 1988. Pods were placed in 1.8-liter paper cartons that were wrapped with aluminum foil and fitted with a 5-ml vial to trap phototropic chalcids (McDaniel and Boe 1990). Emergence of adult chalcids began in late March and continued through mid-June of

1989. Vials were checked daily and numbers of chalcids trapped were determined.

Female and male reproductive structures were studied for ovipositor sheath length, number of rami spines, number of 8th tergite setae, and male reproductive apparatus length. Reproductive structures for both sexes are illustrated.

Bruchophagus grisselli McDaniel and Boe, New Species

Female.—Length 1.7 to 2.5 mm; head dark black; mesosoma black; pronotum, propodeum, petiole, gaster black; antennal scape with basal area orange-yellow, apex darkened; pedicel, flagellum darkened; sensilla as shown in Fig. 1 for left antenna; maxillary palp brown and yellow; mandibles yellow with darkened teeth; legs with coxae black at attachment of trochanter, orange-yellow at attachment to tibia; second femur with black oval spot near attachment to trochanter, rest of femur orange-yellow; third femur completely black except for small orange-yellow area at attachment of tibia; tibia and tarsus of all legs orange-yellow, first and second tibia without any brown markings, third tibia with some brown markings; tarsus of all without any dark coloring, color lighter than tibia (more yellow with no orange tinge); hind coxae larger than coxae of first and second legs; all coxae covered with piliferous punctures; head with deep piliferous punctures dorsally between ocelli not extending past posterogenal region; frons concave between eyes; antennal scrobes at base of concave frons; scape longer than pedicel and first funicular segment together; funicular segments with sensilla as shown in Fig. 1; club segments fused, 3 in number, first two similar in size, last segment broad at base, narrowing to rounded apex (Fig. 1); mesosoma collar broad, with piliferous punctures; pronotum with piliferous punctures; scutellum convex, with piliferous punctures associated with curved white setae; mesosoma forming a deep sloping angle toward nuda; wings with very lightly pigmented setae sparsely arranged over disc; marginal vein longer than postmarginal; parastigma with clear region at attachment to marginal; stigmal longer than postmarginal, shorter than marginal; submarginal vein with 9 dorsal setae, single sensillum behind first dorsal submarginal seta; dorsal parastigma with two sensilla; costal cell with single row of dorsal setae, ventral surface with scattered setae; parastigma with two large setae similar in structure to submarginal setae; speculum closed; cubital and medial hairlines distinct on dorsal surface; medial hairline connected with cubital hair line in region of speculum; basal hairline distinct, connecting cubital hairline closing speculum; radial cell with setae; fringe extends around wing from postmarginal vein to region of speculum, devoid of fringe setae from speculum region to submarginal vein; propodeum deeply slanted with punctures similar to those on scutellum; abdomen without enlargement of sixth segment; ovipositor (Fig. 3) second valvifers (Vf2) with 2 semicircular sheath spines near apodemes of laminated bridge (Lam.Br.); ramus (Ra.) with a range of from 32 to 40 spines (Ra.Sp.) on right valvifer (mean of 36.0 for 10 specimens), and from 32 to 37 on left valvifer (mean of 34.9 for 10 specimens), spines widely spaced in laminated bridge area, close together near fulcral plate area; fulcral plate (Ful.Pl.) attachment of ovipositor outer plate (Ops.Ot.Pl.) near fulcral plate notch (Ful. Pl. Not.); fulcral plate with deep notch, head region with pointed apex; outer ovipositor plate fused with eighth tergite (8-Teg.) sclerotized, plated, ventral area membranous; eighth tergite with paired setae (8-Teg.Set.) extending from cercus (Ce.) toward attachment of fulcral plate, fused ovipositor outer plate, and eighth tergite; number of setae ranging from 63 to 76 (mean of 69.7 for 10 specimens), setal region plated similar to dorsal fused area of ovipositor outer plate; eighth tergite separated from ventral region of ovipositor

outer plate by a dark band that extends from fused dorsal area of ovipositor outer plate to cercus; epipygium (Ep.) with series of long setae; cercus with five setae of different sizes and shapes; ovipositor inner plate (Ops.In.Pl.) separated from second valvifers by darkened region that connects apodemes of outer and inner rami and apodemes of laminated bridge, darkened area separates centers of second valvifers, darkened area narrow where it connects with laminated bridge apodemes widening where it connects with lower valvifer apodeme, darkened region separates ovipositor inner plate from membranous centers of second valvifers; lower valvifer ramus fused with fulcral plate extending to area containing four monitoring spines (Ful.Pl.Sp.); ovipositor inner plate and apodemes of laminated bridge fused forming shaft for ovipositor (Ops.); ovipositor inner plate near darkened area lightly plated, heavy plating of ovipositor inner plate begins at region forming groove in which fulcral plate apex fits; ovipositor inner plate heavy plating ends before region of fused ovipositor sheath (Ops.Sh.); ovipositor sheaths not articulated, connected to each other by ovipositor ligament (Ops.Sh.Lg.); ovipositor sheath lightly sclerotized except for small region below ovipositor sheath ligament; ovipositor sheath length ranged from 285 to 345 microns for 10 specimens (Fig. 6); ovipositor sheath setae (Ops.Sh.Set.) grouped together at apex; ovipositor with typical *Bruchophagus* teeth on the shaft with a single median tooth followed by paired lateral teeth.

Male.—Length 1.4 to 2.1 mm; color similar to female with head dark black; mesosoma, pronotum, scutum, scutellum and propodeum black; antennae with scape elongated swollen near connection to petiole; funicular segments well-separated, each with sensilla and long setae as shown in Fig. 2; 5th funicular segment not separated from club except by a transvese suture; legs similar to female; maxillary palps and mandibles similar to female; wings with darker setae, more numerous in disc region than female; submarginal vein with nine setae; parastigma with setae similar in structure to submarginal setae; submarginal vein with same placement and number of sensilla as female; costal cell same as female; basal setae connecting cubital hairline closing speculum; reproductive apparatus (Figs. 4, 5) parameres with 3 setae (Par.Pl.Set.), one associated with apex which is usually hidden between the digiti (Dgi.) and aedeagus (Aeg.); other two paramere setae on narrow arm of fused paramere plates (Fus.Par.Pl.), the latter larger than apical setae; digiti with two teeth (Dgi.Teth.) and a thumb-like projection; aedeagus dorsally covers digiti and caulis (Ca.); aedeagus with four sensory pores (Aeg.S.Por.), these staggered, one pair located within striae region, striae (Aeg.Dos.Str.) not reaching to second pair of sensory pores; aedeagal dorsal striae of different lengths; ventral apex of adeagus with three ventral pores (Vt.Por.) on each side, these smaller than dorsal sensory pores; reproductive apparatus elongated length measured from digital apodemes (Dgi.Apd.) 330 to 460 microns (mean of 384 microns for 10 specimens); aedeagus capable of extending beyond aedeagus digiti; attached to dorsal surface is the aedeagal epipygium ligament which controls the distance aedeagus can be extended from reproductive apparatus; digital apodemes protrude from caulis dorsally; caulis, paramere plate and volsellar plate fused; paramere plate region that contains paramere setae pigmented; caulis center region transparent; caulis forms dorsal opening (Dor.Opn.Shp.) where aedeagal apodemes protrude; internal penis valves (Pv.) extend to apex of aedeagus.

The following key can be used to separate *B. grisselli* from *Bruchophagus caraganae* (Nikol'skaya) and *B. mexicanus*. The latter two species are the only other *Bruchophagus* species found in North America with known legume hosts other than *Medicago, Trifolium,* and *Lotus* species.

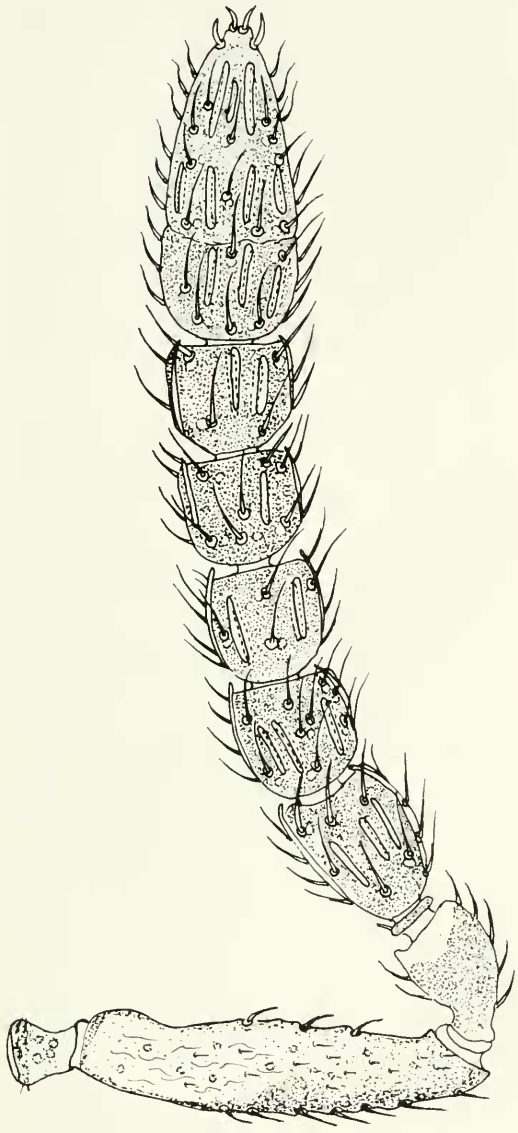


Fig. 1. Female antennae of *Bruchophagus grisselli* n. sp.

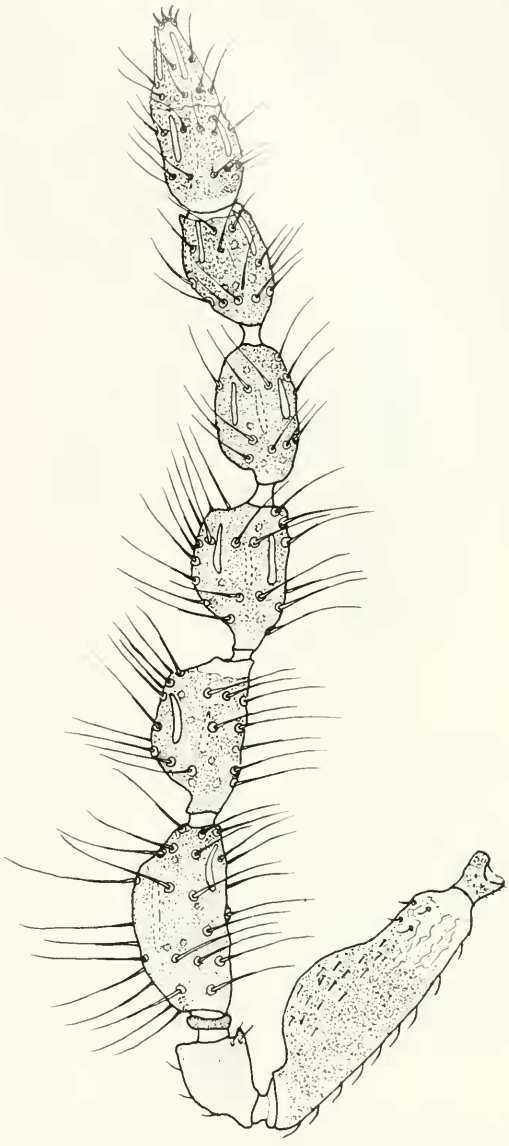


Fig. 2. Male antennae of *Bruchophagus grisselli* n. sp.

1a. Legs with orange color interspersed with brown 2

1b. Legs without orange color; legs black interspersed with light yellow; ovipositor sheath length 450–470 microns .... *Bruchophagus caraganae* (Nikol'skaya) associated with *Caragana arborescens* Lam., *C. frutescens* DC, and *C. pygmaea* DC.

2a. Tibia I without any interspersed brown color, forewing of female with setae very light in color, wing appears transparent; ovipositor sheath length 285–345 microns .... *Bruchophagus grisselli* n. sp. associated with *Glycyrrhiza lepidota* Pursh.

2b. Tibia I with brown color interspersed; forewing of female with dark setae; ovipositor sheath length 200–220 microns .... *Bruchophagus mexicanus* Ashm. associated with *Astragalus bisulcatus* Gray, *A. mollissimus* Torr., and *A.* sp.

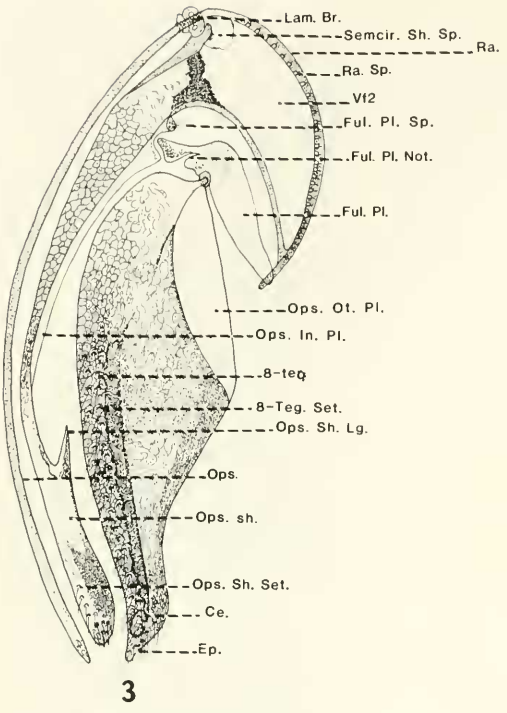


Fig. 3. Female genitalia of *Bruchophagus grisselli* n. sp.

Abbreviations used for female genitalia: (Lam.Br.) Laminated bridge; (Semcir.Sh.Sp.) Semicircular sheath spine; (Ra.) Ramus; (Ra.Sp.) Ramus spines; (Vf2) 2nd valvifer; (Ful.Pl.Sp.) Fulcral plate spines; (Ful.Pl.Not.) Fulcral plate notch; (Ful.Pl) Fulcral plate; (Ops.Ot.Pl.) Ovipositor outer plate; (Ops.In.Pl.) Ovipositor inner plate; (8-Teg.) 8th tergite; (8th.Teg.Set.) 8th tergite setae; (Ops.Sh.Lg.) Ovipositor sheath ligament; (Ops.) Ovipositor; (Ops.Sh.) Ovipositor sheath; (Ops.Sh.Set.) Ovipositor sheath setae; (Ce.) Cercus; (Ep.) Epipygium.

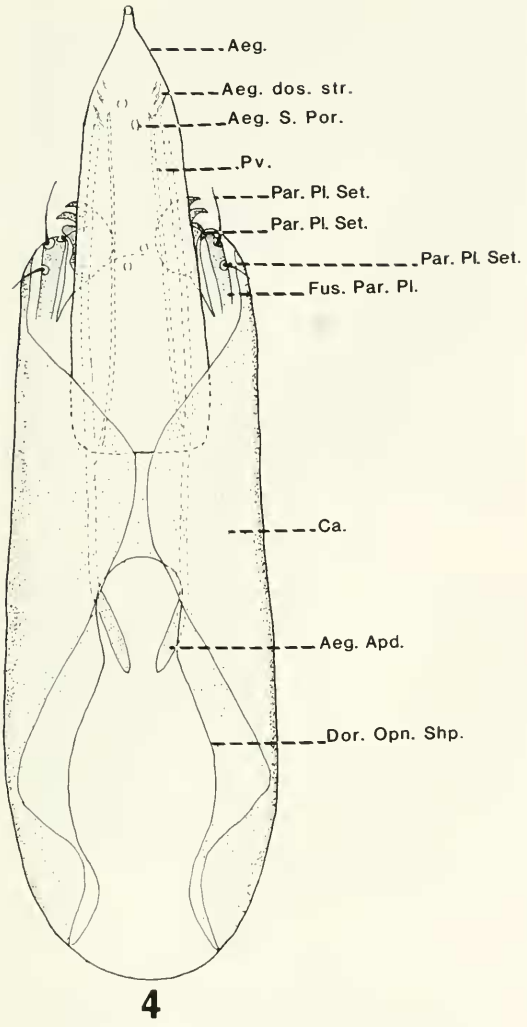
Males of *B. grisselli* can be separated from males of *B. caraganae* and *B. mexicanus* by shape of the dorsal opening, overlapping of the caulis, length of the reproductive apparatus, and number of striae on the aedeagus. Specimens of *B. caraganae* and *B. mexicanus* utilized for construction of the key were collected near Redstone, Montana in July, 1989 from *C. arborescens* and *A. bisulcatus,* respectively. Specimens of both species are housed in the South Dakota State University H. C. Severin Museum at Brookings, South Dakota.

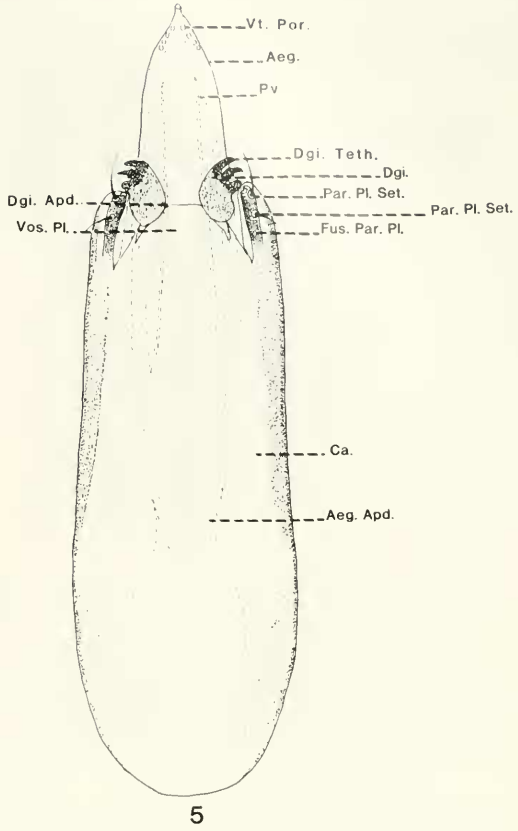
We have not seen specimens of *B. glycrrhizae,* which has been reared from *G. glabra* seeds in Europe. However, Dr. E. E. Grissell examined 5 females and 5 males of *B. grisselli* and determined that they were not *B. glycyrrhizae.* Since *G. glabra* has been introduced into North America, the scenario of *B. glycrrhizae* being introduced with its European host and then infesting the North American native *G. lepidota* seemed possible. In a key constructed for species of *Bruchophagus* from the European part of the USSR, Zerova (1987) states that the third abdominal tergite is distinctly longer than the fourth in *B. glycyrrhizae.* The third and fourth abdominal tergites are subequal in length in *B. grisselli.* We studied descriptions in the literature of the described North American *Bruchophagus* species with no known hosts (i.e. *B. borealis, B. sculptus,*

Table 1. Numbers of *Bruchophagus grisselli* McDaniel and Boe reared from pods of *Glycyrrhiza lepidota* Pursh from North and South Dakota.

State	County	Location	Trapping Period	No. Females	No. Males
N.D.	Renville	1	5/11/89	1	0
N.D.	Renville	2	4/30/89	0	1
N.D.	Renville	3	5/1–5/27/89	7	7
S.D.	Mellette		4/24–6/15/89	20	23
			4/4–4/23/90[1]	8	6
S.D.	Davison		4/29–5/19/89	72	50
S.D.	Hamlin		4/21–4/26/89	1	1
		Total		109	88

[1] Emergence dates of individuals from same cages that contained individuals that emerged from 4/24 to 6/15/89. All seeds were collected 9/16/89 and placed in rearing cages at room temperature.





Figs. 4–5. Male reproductive apparatus, dorsal and ventral, of *Bruchophagus grisselli* n. sp.

Abbreviations used for male reproductive apparatus, dorsal and ventral: (Aeg.) Aedeagus; (Aeg.Dos.Str.) Aedeagal dorsal striae; (Aeg.S.Por.) Aedeagal sensory pore; (Pv.) Penis valves; (Par.Pl.Set.) Paramere plate setae; (Fus.Par.Pl.) Fused paramere plate; (Vos.Pl.) Volsellar plate; (Ca.) Caulis; (Aeg.Apd.) Aedeagal apodemes; (Dor.Opn.Shp.) Dorsal opening shape; (Dgi.) Digiti; (Dgi.Teth.) Digiti teeth; (Dgi.Apd.) Digiti apodemes. (Vt.Por.) ventral pores.

and *B. noctua*) and determined that *B. grisselli* was distinct based on these descriptions (Ashmead 1887, 1894, Bugbee 1965, Girault 1916, 1920).

Specimens examined.—Holotype female: South Dakota, 12km west of Ethan, Davison Co.; emerged May 19, 1989 from seeds of *Glycyrrhiza lepidota* collected September 29, 1988 B. McDaniel and A. Boe. Allotype male same location as holotype. Paratypes: South Dakota; 4 females, 4 males; same data as holotype (these have abdomen removed and genitalia mounted on slides); White River, Mellette Co. 2 females, 2 males, collected September 4, 1988, B. McDaniel; Lake Norden, Hamlin Co., 2 females, 2

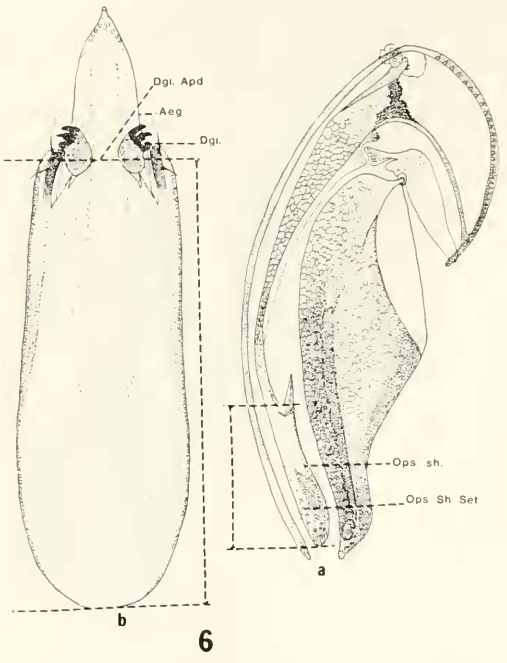


Fig. 6. a. ovipositor sheath showing how length is measured. b. male reproductive apparatus showing how length is measured.

males, collected August 6, 1988, A. Boe; North Dakota 1km north of Sherwood, Renville Co. 1 female, 1 male, collected August 14, 1988, Lisa Trout; all specimens were obtained from seeds of *Glycyrrhiza lepidota*. The holotype and allotype along with paratypes will be deposited with the USNM.

Results and Discussion

B. grisselli adults were reared from seeds of *G. lepidota* for 6 out of the 8 collection sites. The North Dakota sites were approximately 10 km south of the Canadian border while the Mellette Co., South Dakota site was approximately 30 km from the Nebraska border. These data suggest *B. grisselli* is widespread in *G. lepidota* populations throughout the northern Great Plains. Since pod sample weights were comparable (approximately 100 g) for all sites, it is evident that the level of seed predation by *B. grisselli* varied considerably among sites (Table 1). The Davison Co. site in South Dakota produced over 60% of the total number of *B. grisselli* adults trapped in this study. For those sites from which only a few *B. grisselli* adults were reared, large numbers of the bruchid beetle *Acanthoscelides aureolus* were trapped. *A. aureolus* adults were also obtained from the Davison Co. collection but the ratio of *B. grisselli* to *A. aureolus* was greater than 2 to 1. *A. aureolus* appears to be a more significant seed predator than *B. grisselli* throughout the northern Great Plains (Boe et al. 1988), but this study indicates *B. grisselli* can also have a substantial impact on seed production of *G. lepidota*.

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